The Soja and Luzzone nappes : discovery of a Briançonnais element below the front of the Adula (NE Ticino, Central Alps)

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The Soja nappe is a small tectonic unit situated below the front of the Adula nappe in NE Ticino. It is classically characterized by a dam- to hm-thick sliver of paragneiss of presumed Late Paleozoic age, partly conglomeratic (sometimes called "Verrucano"), and is traditionally considered as rooted below the Adula nappe.
Stratigraphic and structural analysis based on detailed mapping of this gneissic body and its Mesozoic cover reveals the following facts:

1. The classical Soja nappe consists of two distinct parts separated by a wide landslide:
   a. A southern part extends over 3.5 km NW of Val Soi (the type-locality) before it disappears below the landslide.
   b. NE of the landslide, the gneiss can be followed over 7.5 km in the slopes S of the Lago di Luzzone and in the Valle di Garzora.

Each part is homogeneous in its stratigraphic content, while there are significant differences between the southern and the northern parts, as explained below. Consequently their connection below the landslide is improbable and we better consider them as two distinct tectonic elements. The southern element is by definition the Soja nappe s.str.. We call the northern element the Luzzone nappe.
Both nappes have the structure of an isoclinal anticline with a Paleozoic core. Mesozoic is well developed in both limbs of the Luzzone nappe, but only in the normal limb of the Soja s.str. nappe.

2. Old gneiss: The Soja s.str. element contains an anticlinal core of gneiss with hints of pre-Alpine metamorphism. The Luzzone nappe shows no evidence of such an old, polymetamorphic gneissic basement.

3. Late Paleozoic paragneiss: This is the characteristic lithology of the classical Soja nappe.
   a. Luzzone nappe: It mainly consists in well-bedded, fine-grained, micaceous and chloritic arkosic meta-sandstones. Dark brown spots of an ankeritic carbonate are omnipresent. In its upper part it may contain thin layers of dolomite and conglomeratic intercalations. This formation shows definite affinities with the Moosalp Formation in central Valais, of Permian age, which is a characteristic lithostratigraphic unit of the external part of the Paleozoic Briançonnais paleogeographic domain, or, in tectonic terms, of the lowest tectonic elements of the Grand St-Bernard nappe S of Visp (Zone Houillère and the overlying St-Niklaus syncline).
   b. Soja nappe s.str.: The general lithology is similar but the carbonate spots or intercalations are rarer. In the inverse limb of the nappe the stratigraphically upper part is enriched in conglomerates. The Moosalp-type characteristics are less obvious.

4. Triassic: In both nappes the paragneiss is overlain by a white, pure quartzite (presumed of Early Triassic age) that passes transitionally to a thick series of limestones and dolomites. This carbonate series differs in the N and S elements:
   a. Luzzone nappe: The carbonate series displays typical characteristics of the Triassic Briançonnais domain. Even if tectonic deformation prevents to draw a complete stratigraphic column, very characteristic facies can be identified. Most typical is the St-Triphon Formation (of Anisian age), characterized by its calcaires vermiculés with their specific ichnofossils. The stratigraphic transition from the quartzite to the carbonate sequence, well exposed at several places with alternating layers of quartzites, greenish metapelites and dolomites underlying a first m-thick bed of yellow dolomite, can also be convincingly parallelised with the base (Dorchaux Member) of the St-Triphon Limestone in classical Briançonnais cross-sections. The Carnian dolomitic breccia has also been recognized.
      These features definitely assign the Luzzone Triassic to the Triassic Briançonnais domain.
   b. Soja nappe s.str.: The dolomites predominate, but thin layers of limestone are also present at the base. Several distinct levels of dolomite have been identified and present a good lateral continuity. No typical Briançonnais feature has been observed.

5. Jurassic: Absent in Soja s.str.. It is well developed in both limbs of the Luzzone nappe as a dam- to hm-thick series of dark blue or black pelitic schists and calcschists, classically presumed Liassic (to early Dogger?), an age that we consider as very probable. Our observations confirm that the contact of this series upon the Luzzone Triassic is stratigraphic. This series is overthrusted by another one with a very similar lithology, where the presence of a Sinemurian ammonite (Arnioceras sp., A. Uhr, unpubl.) supports the stratigraphic interpretation. Both together belong to the Piz Terri – Lunschania zone of the literature. This means that a large part of the Piz Terri – Lunschania

zone belongs to the Luzzone nappe, which extends considerably the surface of this tectonic unit towards NE. Characterized by two relatively coarse detrital inputs above a mainly marly base and topped by a black calcite-free pelite, these series show a clear affinity with the Helvetic (s.l.) Liassic stratigraphy.

Conclusion:

The most important point is the typical Briançonnais affinity of the Paleozoic and Triassic sections of the Luzzone nappe. Particularly in the Triassic, the observed features belong to the core of the definition of the Briançonnais domain s.l. (i.e. including the Subbriançonnais) and of its use as a tool for paleogeographic correlations along the Alpine arc (Briançon Alps, Vanoise, Préalpes Médianes and Grand St-Bernard nappe in central Valais). As the Adula Triassic is not Briançonnais (see Cavargna-Sari et al., this session), the Luzzone nappe (including a large part of the Piz Terri – Lunschania zone) must have an ultra-Adula homeland. Originating S of the Adula, it must have passed over it, probably during subduction of the Adula, to be finally overtaken by its front when the Adula nappe was exhumed.

Another remarkable point is the Helvetic affinity of the Liassic section of the same Luzzone nappe. The stratigraphic superposition of a Jurassic series of Helvetic (s.l.) type over a typically Briançonnais Triassic has major paleogeographic implications.

The classical Soja nappe is often correlated with the Lebendun nappe of NW Ticino and Italy. Our observations in both areas show that the similarity of the Lebendun gneiss with the Soja or Luzzone gneisses is superficial. The Soja s.str and the Luzzone nappes have nothing to do with the Lebendun.